

# इंटरनेट

# मानक

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IS 11630 (2005): Method for Ultrasonic Testing of Steel Plates for Pressure Vessels and Special Applications [MTD 21: Non-Destructive Testing]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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भारतीय मानक

दाब पात्रों और विशेष अनुप्रयोगों के लिए  
इस्पात प्लेटों की पराश्रव्य परीक्षण की पद्धति  
( पहला पुनरीक्षण )

*Indian Standard*

METHOD FOR ULTRASONIC TESTING OF  
STEEL PLATES FOR PRESSURE VESSELS  
AND SPECIAL APPLICATIONS

*( First Revision )*

ICS 77.040.20.77.140.30

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**BUREAU OF INDIAN STANDARDS**  
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## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Non-destructive Testing Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1986. It has now been revised in the light of the experience gained in this field. In this revision, following modifications have been carried out:

- a) Reference clause has been added.
- b) Equipment clause has been modified.
- c) A new clause on testing personnel has been added.
- d) Procedure clause has been modified.
- e) Scanning clause has been modified.
- f) Recording clause has been modified.
- g) Acceptance level clause has been modified.
- h) A new clause on rehearing has been added.

This standard should be used in conjunction with:

- a) IS 3664 : 1981 Code of practice for ultrasonic pulse echo testing by contact and immersion method (*first revision*)
- b) IS 4225 : 2004 Recommended practice for straight beam ultrasonic testing of steel plates (*second revision*)

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## *Indian Standard*

# METHOD FOR ULTRASONIC TESTING OF STEEL PLATES FOR PRESSURE VESSELS AND SPECIAL APPLICATIONS

*( First Revision )*

## 1 SCOPE

**1.1** This standard covers the procedure for ultrasonic testing of hot-rolled heat treated low alloy and plain carbon steel of 12 mm and over in thickness by normal beam pulse echo method. It also specifies the two grades of steel plates.

**1.2** Grade 1 is intended primarily for plates used for pressure vessel applications; for other special application plates can be supplied conforming to Grade 2 of this standard.

**1.3** For plates below 12 mm in thickness, method of testing and acceptance criteria shall be mutually agreed at the time of ordering.

## 2 REFERENCE

The following standard contains provision, which through reference in this text, constitutes provision of this standard. At the time of publication, the edition was valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

<i>IS No.</i>	<i>Title</i>
13805 : 2004	General standard for qualification and certification of non-destructive testing personnel ( <i>first revision</i> )

## 3 EQUIPMENT

### 3.1 Ultrasonic Apparatus

The equipment shall be of pulse echo type capable of generating frequencies over the range of at least 1 MHz to 6 MHz. Instruments operating at other frequencies may be used if equal or better sensitivity can be demonstrated or documented. The equipment shall be capable of providing linear vertical presentation within  $\pm 5$  percent of the full screen height for 20 percent to 80 percent of the screen height.

**3.1.1** The equipment shall be provided with an amplitude control which is calibrated minimum in steps of 1 or 2 dB and accurate over its useful range to  $\pm 20$  percent of the nominal amplitude ratio.

**3.1.2** The equipment shall have a time base which is linear within  $\pm 20$  percent over its full range and have length appropriate to the geometry of the parts to be tested.

### 3.2 Transducer

The transducer shall be normal beam compression wave type and is normally 25 to 30 mm in diameter maximum in diameter. Other search units may be used for evaluating and pinpointing indications.

## 4 PERSONNEL

Personnel conducting examination shall be trained and certified as per IS 13805.

## 5 PROCEDURE

**5.1** The ultrasonic examination shall be normally carried out on one surface only. Examination to be carried out in an area free of operations that interfere with proper performance of the test.

**5.2** With special agreement between purchaser and the manufacturer, if required, examination from both the surface (top and bottom) may also be carried out.

**5.3** Plates ordered in heat treated condition shall be tested after specified heat treatment.

**5.4** The plates to be examined shall be clean and smooth so as to maintain a first reflection from the opposite side from the defect free zone of the plate at least 80 percent of the full scale during scanning. If the above condition is not possible to be attained due to presence of surface scale, use of grinding or other means of scale removal shall be followed to obtain proper coupling of transducer with material under test.

**5.5** Direct contact, immersion or liquid column coupling shall be used to perform the test. Suitable couplant such as water, oil or glycerine shall be used.

**5.6** A nominal test frequency of 4 MHz is recommended. When testing plates less than 20 mm thick, higher frequency of 6 MHz may be necessary. Lower frequencies

may be used, if the signal to noise ratio is not adequate. A clean, easily interpreted trace pattern should be produced during the examination.

5.7 Thickness, grain size or microstructure of the material and nature of equipment or testing method may require higher or lower test frequency.

5.8 Transducer of frequency 1 MHz and below may be used with special agreement between the supplier and the purchaser.

## 6 SCANNING

6.1 For Grade 1 plate, the scanning shall be along continuous perpendicular grid lines on nominal 150 mm centres or all the options of manufacturers shall be along continuous parallel paths, transverse to the major plate axis, on nominal 100 mm centres, or shall be along continuous parallel paths parallel to the major plate axis, on 75 mm or smaller centres. Measurement shall be from the centre or one corner of the plate with an additional area within 50 mm of all edges of the plate on the searching surface.

6.2 For Grade 2 sheared and gas cut plates, edge testing shall be carried out on extreme edges along sides, parallel to the edges. The width of tested region shall not be less than 50 mm. Additional scanning shall also be carried out along the centre of the width and length parallel to the edges. The width of the scanned portion shall not be less than 75 mm.

6.3 Pattern of scanning other than those indicated in 6.1 and 6.2 can be followed with special agreement between the purchaser and the supplier.

6.4 Conduct the general scanning with the instrument adjustment that will produce a first reflection from the opposite side of a sound area of the plate from 80 percent of full scale. Minor sensitivity adjustments may be made to accommodate the surface roughness.

6.5 When discontinuity condition is observed during general scanning adjust the instrument to produce a first reflection from the opposite side of a sound area of the plate of  $75 \pm 5$  percent of full screen height. This instrument setting shall be maintained during evaluation of discontinuity.

## 7 RECORDING

7.1 Record all discontinuities causing complete loss of back reflection.

7.2 For plates 20 mm thick and over, record all indications with amplitudes equal to or greater than

50 percent of the initial back echo or which causes 50 percent loss in back reflection or both.

7.3 Where grid scanning is performed and recordable condition as in 7.1 and 7.2 are detected along a given grid line, the entire surface area of the squares adjacent to this indications shall be scanned. Where parallel path scanning is performed and recordable conditions as in 7.1 and 7.2 are detected, the entire surface area of 150 mm  $\times$  150 mm square centered on this indication shall be scanned.

7.4 The true boundary of the flaw shall be estimated by moving the transducer away from the centre of discontinuity until the height of back reflection and flaw indication are equal. The centre of the transducer shall be marked on the plate. Operation shall be repeated to establish the boundary of the flaw.

## 8 ACCEPTANCE STANDARD — LEVEL I

### 8.1 Edge Lamination

The maximum penetration of the defect in the plate shall be 25 mm to a minimum length of 25 mm. The maximum total length in any 1 m length of the plate shall not exceed 120 mm and maximum average length of the flaw per metre length of the plate shall not exceed 60 mm. The acceptable adjacent discontinuities shall be separated by a minimum distance equal to the greater length of the discontinuity in the group.

### 8.2 Inside

Any area where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 75 mm or 1/2 of the plate thickness, whichever greater is unacceptable.

8.3 In addition, two or more discontinuities smaller than described in 8.2 shall be unacceptable unless separated by a minimum distance equal to the greatest diameter of the larger discontinuity or unless may be collectively encompassed by the circle described in 8.2.

## 9 ACCEPTANCE STANDARD — LEVEL II

### 9.1 Edge Lamination

The maximum penetration of the defect in the plate shall be 50 mm to a maximum length of 50 mm. The maximum total length in any 1 m length of the plate shall not exceed 150 mm and maximum average length of the flaw per metre length of the plate shall not exceed 80 mm. The acceptable adjacent discontinuities shall be separated by a minimum distance equal to the greater length of the discontinuity in the group.

## 9.2 Inside

Any area where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 75 mm or 1/2 of the plate thickness, whichever greater is unacceptable.

## 10 REHEARING

The manufacturer reserves the right to discuss with the purchaser regarding rejectable ultrasonically tested plate with the object of possible repair of the ultrasonically indicated defect before rejection of the plate.

## 11 INSPECTION

The inspector representing the purchaser shall have access at all times, while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the ultrasonic testing of the plates ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be conducted without interfering unnecessarily with the manufacturer's operations.

## 12 MARKING

12.1 All plates accepted to this standard shall have the

grade and specification marked by means of good quality enamel paint or by stenciling (stamping) on one corner of the each plate.

12.1.1 The appropriate quality grade of the plate and the specification number shall be marked by paint.

## 13 REPORT

13.1 Unless otherwise agreed with the purchaser, an ultrasonic test certificate indicating following details shall be supplied to the purchaser.

13.1.1 All recordable indications listed in 7 on a sketch of the plate with sufficient data to enable correlation with the plate.

13.1.2 Test parameters includes:

- a) Material specification;
- b) Plate identification;
- c) Cast number;
- d) Size and thickness of the plate;
- e) Surface condition;
- f) Make and model of UT instrument;
- g) Detail of transducer (type, diameter, frequency, etc);
- h) Detail of couplant;
- j) Date of testing; and
- k) UT operator's name, his level.

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#### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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